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(54) Heat exchanger.

(57) A heat exchanger comprises a plurality of flat tubes (1), a pair of hollow headers (5 and 6) connected to both ends of each of the flat tubes in fluid communication with them and at least one fastener (10, 11) secured to the headers. Each fasteners (10, 11) comprises at least one self-retainable embracing portion capable of being forced to fit on the header when the fastener is urged towards a side surface of the header, so that the embracing portions gripping the header are brazed thereto. The fasteners (10, 11) can be temporarily fixed, without aid of any special tools, on a heat exchanger body before they are "one-shot" brazed one to another in an oven, thus rendering easy the manufacture of heat exchanger. Due to the special tools dispensed with, a greater number of temporarily assembled heat exchangers can be accommodated in one oven, thus improving to a remarkable degree the productivity in manufacture of the heat exchanger.

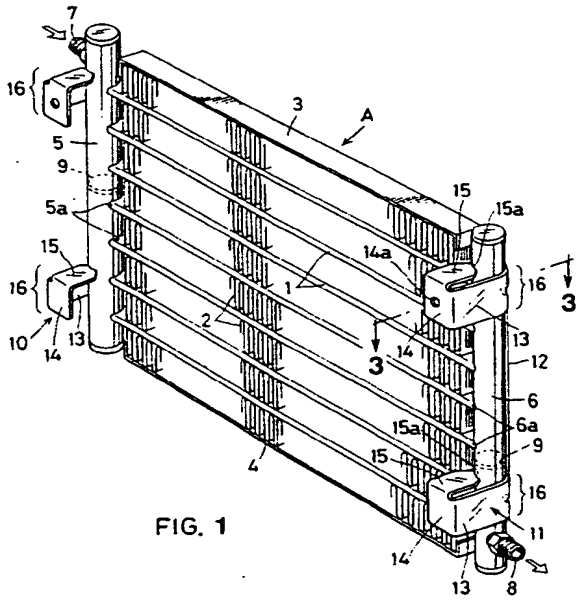

FIG. 1

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a heat exchanger for use as a condenser in the automobile air conditioner or room air conditioner system, as an evaporator, oil cooler or the like.

2. Description of Prior Art

The so-called multi-flow type of heat exchanger is known and used as the condenser in the automobile air conditioner system. This heat exchanger comprises a plurality of flat tubes disposed in parallel with each other, and a plurality of fin members each interposed between two adjacent tubes, wherein both ends of each tube are connected to hollow cylindrical headers in fluid communication therewith.

The headers of those heat exchangers comprise certain fasteners which are used for example to mount said heat exchangers as the condensers of air conditioner on the car bodies, or otherwise to connect some accessories to the heat exchangers. It has been a common practice to temporarily fix the fasteners on outer peripheries of the headers at desirable portions thereof. The fastners have been brazed, in an oven, to the headers so as to become integral with them.

The temporary fixing of the fasteners has however been troublesome and not easy to operate, because certain specially designed tools or attachments must be used. When brazing the components or parts of each heat exchanger in the so-called "one-shot operation" manner, such tools or attachments decreases the number of temporarily assembled heat exchangers which can be accommodated in the oven, and thus lower the productivity in manufacture of the heat exchangers.

OBJECTS AND SUMMARY OF THE INVENTION

In view of the drawback in the prior art, the present invention aims to provide a heat exchanger which does not need any special attachment to temporarily fix fasteners on headers of the heat exchanger, thereby improving the manufacture productivity thereof.

Further objects and advantages of this invention will become clear in the embodiments which will be given herein-after only by way of example to demonstrate the preferred modes. Therefore, this invention is not limited to these embodiments but permits many other modifications falling within the range and spirit of the invention.

A fastener as one constituent of a heat exchanger provided in the present invention comprises at least one embracing portions capable of being forced to fit on a header, when the fastener is urged towards a side surface of the header. Each embracing portion is self-retainable around the header portion which is gripped by the embracing portion. Due to such a self-retaining of the embracing portions, the fastener is temporarily fixed on the header so that they are placed in an oven and brazed integral with each other when all the other constituents are mutually brazed to construct the heat exchanger in the so-called "one-shot" operation.

Thus, according to the invention, the heat exchanger comprises a plurality of flat tubes, a pair of hollow headers connected to both ends of each flat tube in fluid communication therewith, and at least one fasteners secured to the headers, and is characterized in that each fastener comprises at least one self-retainable embracing portions capable of being forced to fit on the header when the fastener is urged towards a side surface of the header, so that the embracing portions gripping the header are brazed thereto.

The fasteners having such self-retainable embracing portions can, without using any special tools or attachments, be temporarily fixed on the headers so stably that they are placed in the oven together with the main body of heat exchanger. In this way, the fasteners are brazed to the headers so as to become integral therewith while they are embracing the latter. Consequently, the fasteners are secured to the header with enough strength to rigidly mount the heat exchanger for example on an automobile body at its receiving portion.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a heat exchanger in its entirety provided in an embodiment of the invention;

Fig. 2 is an enlarged plan view showing a principal part of the heat exchanger;

Fig. 3 is an enlarged cross section taken along the line 3-3 in Fig. 1;

Fig. 4 is a perspective view showing the heat exchanger with its fastener being separate therefrom before assembled;

Fig. 5 is a perspective view showing a principal part of a second embodiment as a modification of the first embodiment;

Fig. 6 is an enlarged cross section taken along the line 6-6 in Fig. 5;

Fig. 7 is a perspective view showing a principal part of a third embodiment as a further modification of the first embodiment; and

Fig. 8 is another perspective view showing a principal part of a still further modification.

THE PREFERRED EMBODIMENTS

The present invention will now be described in detail and referring to the drawings which show its embodiments applied to a condenser for use in the car air conditioner system.

First Embodiment

In Figs. 1 to 4, the reference symbol "A" denotes a heat exchanger body which comprises a plurality of flat and horizontal aluminum tubes 1 stacked one on another, a plurality of aluminum fin members 2 each interposed between two adjacent tubes 1 and 1, and a pair of left and right headers 5 and 6 which are disposed at both ends of the tubes and fin members.

The tubes 1 are made of a flat extruded profile of an aluminum material. The so-called harmonica tube of a perforated shape may alternatively be used to provide such tubes 1.

Each fin member 2 is a corrugated fin which is repeatedly bent in a serpentine shape and is brazed to the adjacent tubes. It is preferable to employ fin members which have louvers opened up.

Brazed to the outermost corrugated fins 2 are aluminum side plates 3 and 4 respectively positioned outside the fins 2.

Each of the headers 5 and 6 is an aluminum of a substantially circular cross section. Each hollow header 5 and 6 has a plurality of tube insertion apertures 5a or 6a. Both ends of each tube 1 are inserted in the apertures and liquid-tightly brazed thereto. It is recommended to make the headers 5 and 6 from a seam-welded pipe which in turn is manufactured from a brazing sheet with its inner and/or outer surfaces coated with a brazing agent. The fin members 2 may also be made of the brazing sheet so that the tubes 1, the fin members 2, the side plates 3 and 4 and the headers 5 and 6 may be integrated with each other by the so-called "one-shot" brazing process within a vacuum heating oven. A higher productivity will be realized in such a case.

The reference numeral 7 and 8 respectively denote a coolant inlet and a coolant outlet. The further numeral 9 denotes horizontal partitions tightly fixed in the headers so as to divide them into longitudinal chambers. A coolant flows into the heat exchanger body "A" through the inlet 7, and advances through coolant passageways within the heat exchanger body before flowing out of it. The coolant will exchange its heat with that of air, which is flowing through air paths formed between two tubes 1 and 1 and including the fin member 2. As a result of the heat exchange, the coolant will be condensed to become a liquid.

Fasteners 10 and 11 of an aluminum alloy are secured the left and right headers 5 and 6, respectively, so as to rigidly connect the heat exchanger body "A" to receiving members formed for example on an automobile body.

Since the fasteners 10 and 11 are symmetrical with each other, only the right fastener 11 will be described below referring to the reference numerals which are also given to the corresponding portions of the left fastener 10.

As shown in Figs. 1 and 2, the fastener comprises a concave contacting member 12 which extends a predetermined distance along the header 6 and is in contact with about a fourth of the outer periphery of the header. The fastener further comprises: extensions 13 protruding tangentially of the header from side edges of an upper and lower portions of the concave contacting member; tabs 14 respectively extending from extremities of the extensions 13 and in parallel with the tubes 1; and ears 15 each protruding towards the header from and perpendicular to an upper edge of the tab 14.

Each ear 15 has intermediate its side edges a tip end 15a of a convex shape enabling a tight contact thereof with a corresponding portion of the outer periphery of the header 6, as shown in Fig. 2. Another end extends from and slants to the tip end 15a so that the tip end can readily be snapped into its place. The concave contacting member 12 and the tip end 15a of the ear 15 will take their self-retaining position when they cooperate with each other to grip the header 6. Thus, the fastener 11 may be deemed to be composed of a pair of embracing portions 16 and a tie rod or beam connecting them one to another.

One of the tabs 14 has a hole 14a formed through its central portion, and a bolt or the like may be inserted in the hole so as to fasten the heat exchanger to an automobile body or the like. Further, the concave contacting member 12 has a lug 12a protruding towards the header 6, as shown in Fig. 3. On the other hand, the header 6 has an opening 6b corresponding to and engageable with the lug so that the position of the fastener 11 self-retaining and embracing the header 6 can be readily and accurately controlled relative to the header by fitting the lug 12a in the opening 6b.

As shown in Fig. 4, the attaching of the fastener 11 to the header 6 is carried out by forcibly urging the former 11 towards the latter and thereby causing the header 6 to be grasped between the concave contacting member 12 and the ear's 15 tip end 15a, wherein the lug 12a of said member 12

engages with the positioning opening 6b of the header 6 in order to ensure the accurate position of the fastener 11 self-retaining on said header.

The fasteners 10 and 11, which are self-retaining on the respective headers 5 and 6 in this manner without needing any auxiliary means, will then be brought into an oven together with the heat exchanger body "A". All the above-mentioned members will be brazed in their positions one to another to thereby provided a finished heat exchanger, which in use will be fixed to receiving members of for example the automobile body.

Second Embodiment

Fig. 5 illustrates in part a second embodiment of the invention. A fastener 21, which is a pressed single piece of aluminum alloy, also comprises two embracing portions 26 similar to the first embodiment and disposed at an upper and lower ends of a concave contacting member 22. Each embracing portion 26 of the fastener is composed of an extension 23, a tab 24 and an ear 25. In this fastener 21, a connector 27 as a connecting means protrudes from a side edge at a middle height of the contacting member 22, and has a hole 27a for insertion of a bolt or the like. A bulging reinforcing rib 27b is formed integral with and along the connector 27, at its central portion. As shown in Fig. 6, the header 6 has a positioning lug 6c, while the contacting member 22 of the fastener 21 has an opening 22a corresponding to and engageable with the lug 6c, in a manner contrary to that in the first embodiment.

Third Embodiment

Fig. 7 shows a fastener 31 in accordance with a third embodiment of the invention. The fastener 31, which is also an integral piece of pressed aluminum alloy, comprises a concave contacting member 32 of a given length, embracing portions 36 and 36, and a connecting means. The contacting member 32 is adapted to come into a tight contact with the header 6. The embracing portions 36 are capable of tightly holding the header 6 over a little more than a half periphery thereof. The connecting means is a connector 37 integral with and protruding from the contacting member's 32 portion intermediate the embracing portions. A hole 37a for insertion of a bolt or the like is also formed through the connector 37. Similarly to the first embodiment, this fastener 31 has a positioning lug 32a which protrudes inwards from the concave contacting member 32 in correspondence with an opening 6b of the header 6, whereby the fastener can take a correct position.

Fourth Embodiment

Fig. 8 shows a further embodiment of the invention, in which a fastener 41 comprises an embracing portion 46 adapted to tightly hold the header 6, over a little more than a half periphery and along a given adequate length thereof. A connector 47 as a connecting means is spot-welded at its base end to a vertical middle zone of the embracing portion.

Although it is desirable as in the embodiments to form the positioning lug and hole in the fasteners and headers, these lug and hole can be dispensed with.

The invention may be applied also to a radiator or any other heat exchangers, though the embodiments relate to a condenser used in car air conditioner system.

Any embracing structure other than those which have been described above may be employed insofar as the fastener can be forcibly fitted on the header, from its side surface, so as to tightly embrace it in the fastener and to thereby establish a self-retaining state.

In summary, the heat exchanger provided by the invention comprises the fastener which can be snapped to the side of header into the self-retaining and engaging state, so that the fastener is temporarily and fixedly attached to the heat exchanger body, without any auxiliary means being used, before "one-shot" brazing in the oven. Thus, the operation in manufacture of heat exchanger is rendered much easier than in the prior art process. In addition, the drawback that the auxiliary means would otherwise occupy a larger space within the oven will be eliminated in the invention, thereby a greater number of temporarily assembled heat exchangers can be accommodated in one oven, thus improving to a remarkable degree the productivity in manufacture of the heat exchanger.

Further, it is noted that the brazing process is effective to make permanent the self-retaining position of the embracing portion of the fastener. Therefore, the heat exchanger body can be secured, with a sufficient strength, to for example the automobile's portion for receiving the heat exchanger.

Claims

1. A heat exchanger comprising a plurality of flat tubes (1), a pair of hollow headers (5 and 6) connected to both ends of each flat tube (1) in fluid communication therewith and at least one fastener (10, 11) secured to the headers characterized in that each of the fasteners (10, 11) comprises at least one self-retainable embracing portion capable of being force fitted on the

header when the fastener is urged towards a side surface thereof, so that the embracing portions gripping the header are brazed thereto.

2. A heat exchanger according to claim 1, characterized in that the fastener (11) is composed of a pair of spaced apart embracing portions (16) and a tie rod or beam (12) connecting them one to another.

3. A heat exchanger according to claim 1 or 2, characterized in that each embracing portion (16) comprises a concave contacting member (12) which extends along the header and is in a tight contact with an outer periphery of the header, an extension (13) protruding from a side edge of the concave contacting member, a tab (14) integrally extending from an extremity of the extension and perpendicular thereto and an ear (15) protruding towards the header from and perpendicular to an upper edge of the tab (14), whereby the header is forced into a gap between the concave contacting member and a tip end of the ear (15).

4. A heat exchanger according to claim 3, characterized in that the tip end of the ear (15) is of a convex shape positionable on the outer periphery of the header.

5. A heat exchanger according to claim 3, characterized in that the ear (15) has a further edge continuing from and oblique to the tip end so as to face the header whereby the tip end can readily be snapped into place on the header.

6. A heat exchanger according to claim 3, characterized in that the tab (14) has a hole (14a) formed therethrough so as to connect it to another article.

7. A heat exchanger according to claim 3, characterized in that the concave contacting member and the header respectively comprise positioning means effective to position the former relative to the latter.

8. A heat exchanger according to claim 7, characterized in that the positioning means are a lug (12a) protruding towards the header from the concave contacting member and a hole (6b) formed in the header in correspondence with the lug.

9. A heat exchanger according to claim 7, characterized in that the positioning means are a hole (22a) formed through the concave contacting member (22) and a lug (6c) formed on the header in correspondence with the hole.

10. A heat exchanger according to claim 1, characterized in that the fastener (31) is composed of a pair of spaced apart embracing portions (36), a tie rod or beam (32) connecting the embracing portions one to another and a connecting means (37) protruding outwards from the tie rod or beam (32), wherein each embracing portion is of such a C-shape that it tightly embraces slightly more than half of the outer periphery of the header.

11. A heat exchanger according to any preceding claim characterized in that the fastener is an integral piece made by the pressing technique.

12. A heat exchanger according to claim 1, characterized in that the fastener (41) comprises an embracing portion (46) of such a C-shape that it tightly embraces slightly more than half of the outer periphery of the header, a connecting means (47) protruding outwards from the tie rod or beam.

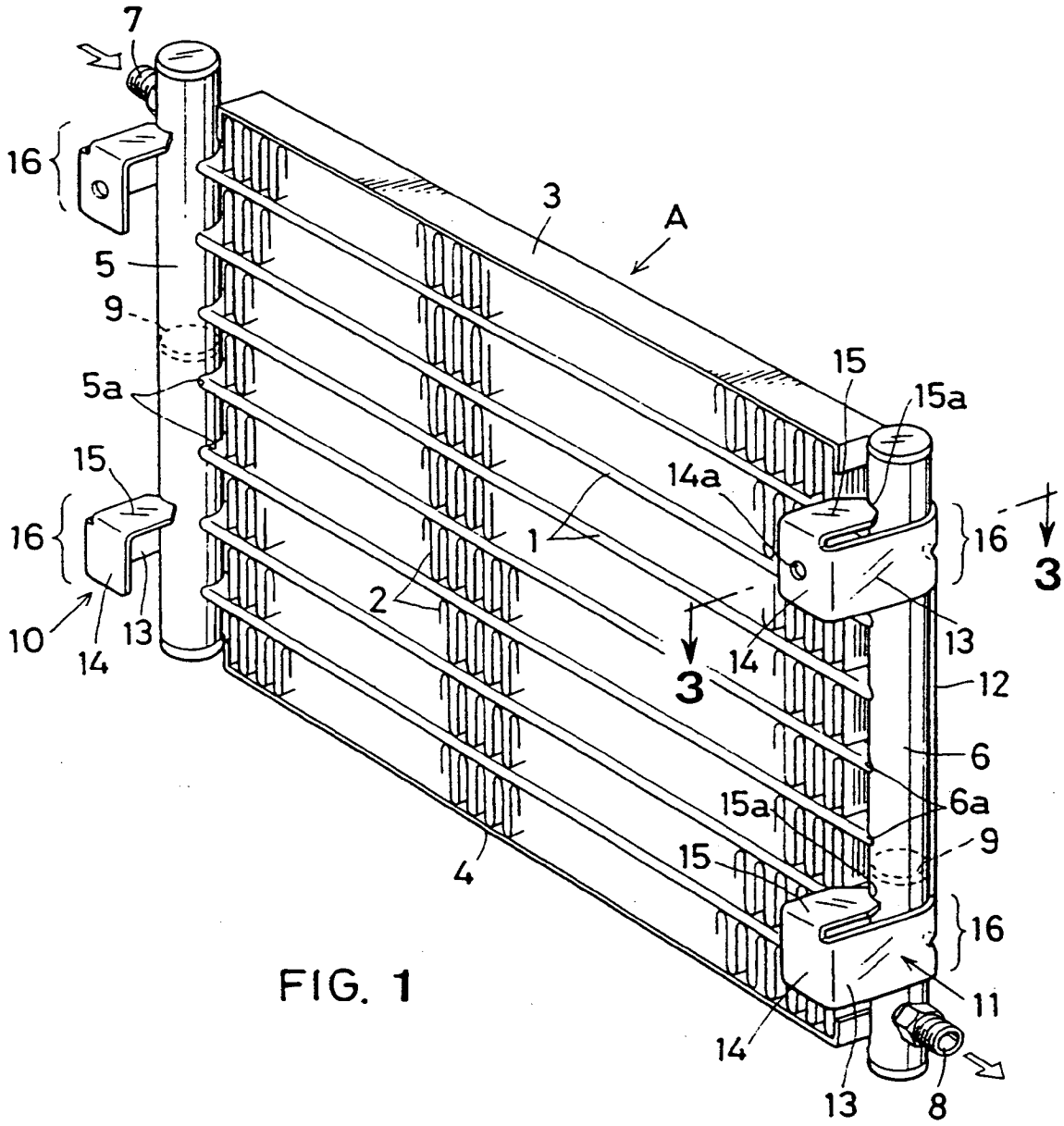
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FIG. 1

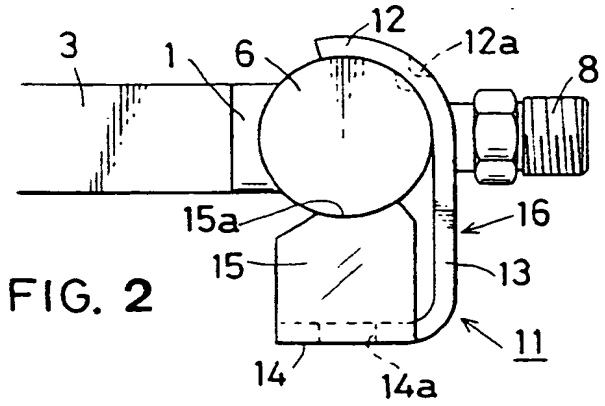


FIG. 2

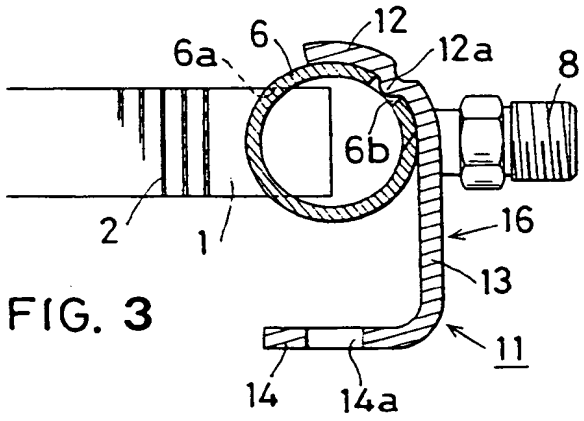


FIG. 3

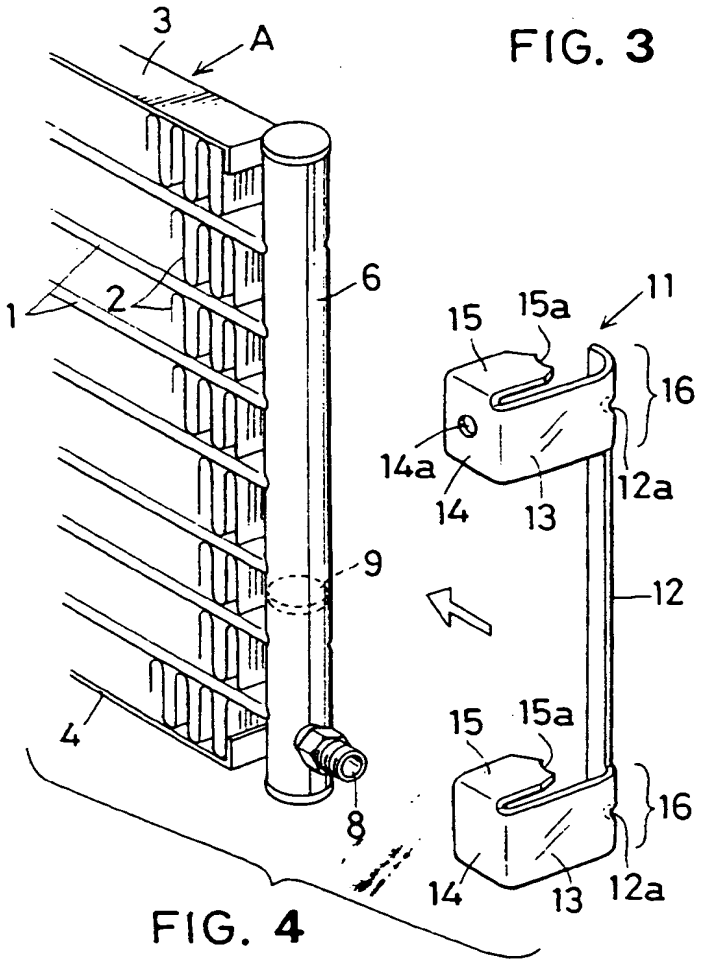
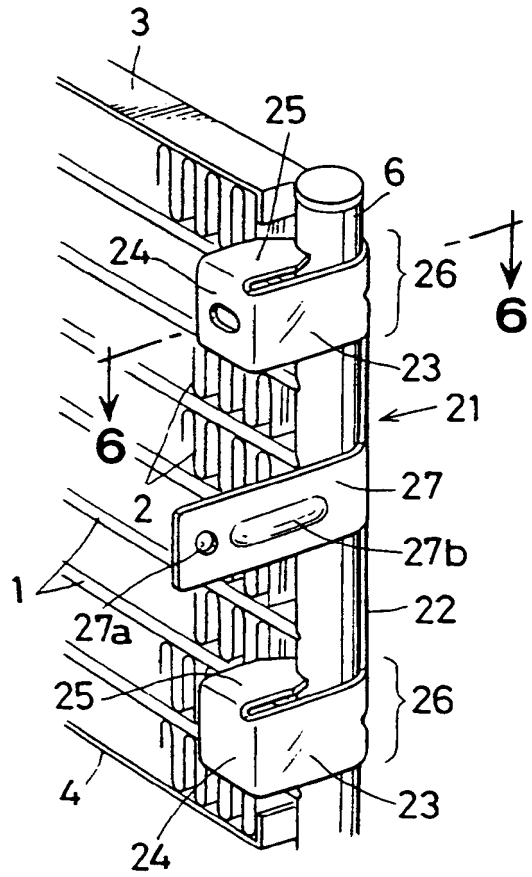


FIG. 4

FIG. 5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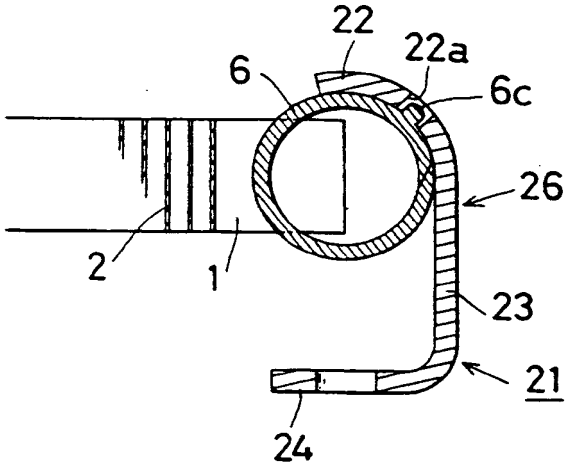
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FIG. 6

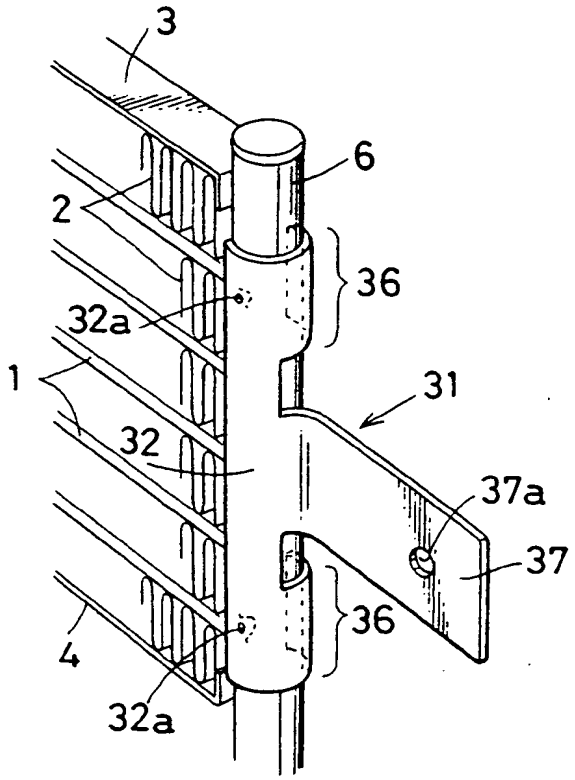

FIG. 7

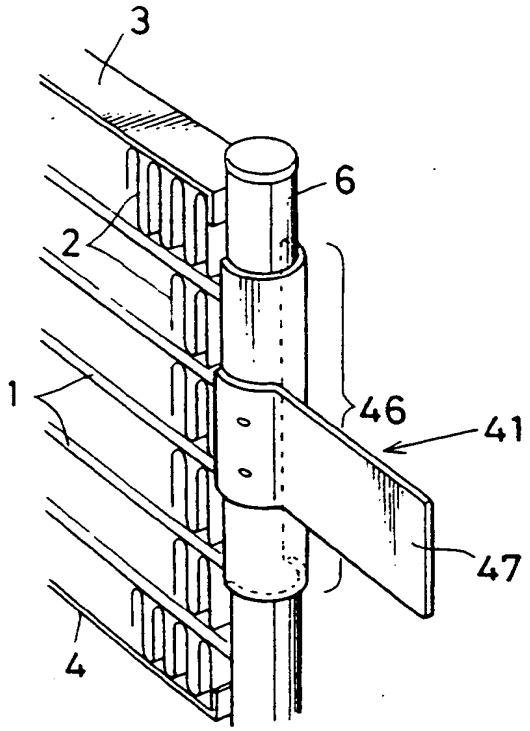

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 9535

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 651 816 (STRUSS) * abstract *	1	F28F9/00 B23K1/00
A	US-A-4 903 389 (WOLF) * abstract *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F28F
B23K
B23P
F24D
B60K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05 FEBRUARY 1992	VAN GESTEL H.M.

CATEGORY OF CITED DOCUMENTS

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